

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



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| Applicant's or agent's file reference<br>Hi-bu 031383wo                                       | <b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416) |  |
| International application No.<br>PCT/EP 03/10269  | International filing date (day/month/year)<br>16.09.2003   | Priority date (day/month/year)<br>16.09.2003 |
| International Patent Classification (IPC) or both national classification and IPC<br>H02J3/12 |  |  |
| Applicant<br>GENERAL ELECTRIC COMPANY et al.  |  |  |

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| <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p>   |
| <p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p> |

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| Date of submission of the demand<br><br>07.04.2005  | Date of completion of this report<br><br>21.11.2005   |
| Name and mailing address of the international preliminary examining authority:<br><br> European Patent Office<br>D-80298 Munich<br>Tel. +49 89 2399 - 0 Tx: 523656 epmu d<br>Fax: +49 89 2399 - 4465 | Authorized Officer<br><br>Zettler, K-R<br><br>Telephone No. +49 89 2399-7554<br><br> |

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/10269

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, Pages

1-9 as originally filed

### Claims, Numbers

1-6 received on 28.09.2005 with letter of 27.09.2005

### Drawings, Sheets

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 4

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

**see separate sheet**

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the Standard.

☐ the computer readable form has not been furnished or does not comply with the Standard.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

|                               |             |         |
|-------------------------------|-------------|---------|
| Novelty (N)                   | Yes: Claims | 1-3,5,6 |
|                               | No: Claims  |         |
| Inventive step (IS)           | Yes: Claims | 1-3,5,6 |
|                               | No: Claims  |         |
| Industrial applicability (IA) | Yes: Claims | 1-3,5,6 |
|                               | No: Claims  |         |

2. Citations and explanations

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see separate sheet

**Re Item III**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

**Claim 4**

In order to perform an intersection, it is necessary to define what is intersected with what. However, claim 4 only defines one "participant" of that intersection, namely the output voltage of a phase of the generator. The other "participant" of that intersection is not defined. This leads to a claim 4 that is unclear to an extent that a meaningful opinion concerning novelty, inventive step and industrial applicability cannot be given.

Therefore, the opinion with regard to novelty, inventive step and industrial applicability is restricted to the claims 1-3, 5 and 6.

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Reference is made to the following document:**

- D1: US 2003/126060 A1 (LOF PER-ANDERS KRISTIAN ET AL) 3 July 2003 (2003-07-03)
- D2: DE 100 10 350 A (SETEC ELEKTRONISCHE ANTRIEBSRE) 13 September 2001 (2001-09-13)
- D3: BLAABJERG F ET AL: "Power losses in PWM-VSI inverter using NPT or PT IGBT devices" POWER ELECTRONICS SPECIALISTS CONFERENCE, PESC '94 RECORD., 25TH ANNUAL IEEE TAIPEI, TAIWAN 20-25 JUNE 1994, NEW YORK, NY, USA, IEEE, 20 June 1994 (1994-06-20), pages 434-441, XP010549405 ISBN: 0-7803-1859-5
- D4: BENNO JÄCKLI: "Energiesparen mit Frequenzumrichter" INTERNET ARTICLE, [Online] 2 December 1996 (1996-12-02), XP002284829 Retrieved from the Internet: URL:[http://www.energie.ch/themen/industrie /fr/>](http://www.energie.ch/themen/industrie/fr/) [retrieved on 2004-06-15]
- D5: BERRINGER K ET AL: "Semiconductor power losses in AC inverters" 8 October 1995 (1995-10-08), INDUSTRY APPLICATIONS CONFERENCE, 1995. THIRTIETH

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IAS ANNUAL MEETING, IAS '95., CONFERENCE RECORD OF THE 1995 IEEE ORLANDO, FL, USA 8-12 OCT. 1995, NEW YORK, NY, USA, IEEE, US, PAGE(S) 882-888, XP010193037 ISBN: 0-7803-3008-0

D6: BIRD/KING/PEDDER: "An Introduction to Power Electronics" 1993, JOHN WILEY & SONS, CHICHESTER, NEW YORK, BRISBANE, TORONTO, SINGAPORE 2, XP002284830 ISBN: 0 471 92616 7

## **2. Preliminary remark**

Taking into account the argumentation detailed in section III, the following reasoning is restricted to the claims 1-3, 5 and 6.

## **3. Clarity**

The application does not meet the requirements of Article 6 PCT, because claim 2 and 3 are not clear.

### **3.1.1 Claim 2**

The expression "decreased up to at least about 10 %" is unclear according to Art. 6 PCT for the following reasons: The wording "up to" defines a percentage range being smaller or equal 10 %, whereas the wording "at least" defines a percentage range starting from 10%. Therefore, the definition "decreased up to at least about 10 %" defines a decrease with any percentage lower, equal or higher than 10 %.

The expression "decreased up to at least about 10 %" is therefore contradictory and in consequence unclear, Art. 6 PCT.

Taking into account teaching on p. 3, last paragraph in the description, it is assumed that the expression should read: "decreased by at least 10 %".

Further, the expression "increased up to at least about 80 %" is unclear according to Art. 6 PCT for the following reasons: The wording "up to" defines a percentage range being smaller or equal 80 %, whereas the wording "at least" defines a percentage range starting from 80%. Therefore, the definition "increased up to at least about 80 %" defines a

increase with any percentage lower, equal or higher than 80 %.

The expression "increased up to at least about 80 %" is therefore contradictory and in consequence unclear, Art. 6 PCT.

Taking into account teaching on p. 3, last paragraph, to p. 4, first paragraph, in the description, it is assumed that the expression should read: "increased to at least 80 %"

### **3.1.2 Claim 3**

For the same clarity reasons explained in par. 3.1.1 already, it is assumed that

- the expression "decreased up to at least about 20 %" should read: "decreased by at least 20 %";
- the expression "increased up to at least about 90 %" should read: "increased to at least 90 %".

## **4. Novelty and Inventive step**

### **4.1 Claim 1**

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1. Using as far as possible the wording of claim 1, document D1 discloses the following (references in the parentheses refer to document D1):

Method for operating a frequency converter of a generator in particular of a wind energy turbine (*Fig. 10; abstract: frequency converter comprises the rectifiers coupled to the wind turbines, the DC grid 1001, the inverters in the premier power facility 505, the prime mover P.M. with the rotating electric machine xM coupled to it*), in the event of a substantial grid voltage drop (*Fig. 10, 20; par. 86-105, 154, 156: in the event of a "voltage-sag" or "short-circuit", i.e. substantial grid voltage drop, xM provides short-circuit power, and therefore the frequency converter can be regarded as being operated in the event of a substantial grid voltage drop*), wherein the frequency converter comprises an AC/DC converter (*Fig. 10: rectifiers coupled to the wind turbines*), to be connected to the generator (*Fig. 10; par. 86*), a DC/AC converter

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(Fig. 10: *inverters in the premier power facility 505*) to be connected to the voltage grid (Fig. 1: *"large scale transmission grid"* is connected to the DC/AC converters in the premier power facility 505), and a DC link circuit for connecting the AC/DC converter to the DC/AC converter (Fig. 1: *DC grid 1001*).

The subject-matter of claim 1 therefore differs from document D1 in that claim 1 defines method step of

- reducing an output voltage of the DC link circuit for increasing an output current of the DC/AC converter and/or
- reducing the operation frequency of electronic switches of the DC/AC converter for increasing the output current of the DC/AC converter.

The problem to be solved by the present invention may therefore be regarded as how to support voltage grid stability.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

D1, Fig. 10, in conjunction with par. 89-105, discloses a rotating electric machine xM to produce additional energy in the event of a voltage sag besides the DC/AC converter. Thus, in contrast to the definitions in claim 1, in order to support voltage grid stability, the additional energy is supplied by a separate rotational electric machine xM, rather than by adapting the operation of the DC/AC converter itself. D2 discloses a pulse inverter that reduces the DC link voltage, when the output AC voltage is reduced. However, D2, col. 1, l. 51-56, and D2, claim 7, indicate that a reduction of the DC link voltage is accompanied with a reduction of the current; the latter is in contrast to the definitions in claim 1 of the international application, whereupon the output current of the DC/AC converter has to be increased. The prior art documents D3, D4 and D5 deal with power losses in inverters; no hint is given how an inverter has to be operated in case of a voltage drop in the grid the inverter is connected to. D6 is a document disclosing technical details of firing the thyristors of a converter.

Thus, none of the prior art documents in the international search report give hints to either reduce an output voltage of the DC link circuit for increasing an output current of the



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DC/AC converter and/or reduce the operation frequency of electronic switches of the DC/AC converter for increasing the output current of the DC/AC converter.

Claim 1 is therefore new and considered inventive, Art. 33(1), Art. 33(2) and Art. 33(3) PCT.

**4.2 Claim 2,3, 5 and 6**

Claims 2, 3, 5 and 6 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step, Art. 33(1), Art. 33(2) and Art. 33(3) PCT.

**5. Industrial applicability**

The industrial applicability in the sense of Art. 33(4) PCT is given for the claims 1-3, 5 and 6.